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Stability of the RBCC-E Triad during the period 2005 - 2015

EUBREWNET

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RBCC-E History

In November 2003, the WMO/GAW Regional Brewer Calibration Center (RBCC-E) was established at the observatory of Izaña (IZO). RBCC-E owns a full calibration and reference-maintenance equipment composed of three spectroradiometers: a primary and secondary reference, Brewer 157 and 183 and a travelling reference, Brewer185, which can be transported for campaigns.

The IZO Triad is linked to the Meteorological Service of Canada Triad by yearly calibrations towards the Canadian Traveling reference Brewer 017. Though the IZO Triad is routinely calibrated by the Langley method. However, the MSC Triad is respected as the official bearer of the GAW Brewer International scale.

Nevertheless, the establishment of the IZO Triad allows implementation of a self-sufficient European Brewer Network which is needed both for present and future quality control and assurance of ground total ozone observation and for validation of satellite instruments. The function of RBCCE-E also allows development and testing of new measurements techniques applied to UV or AOD measurements.

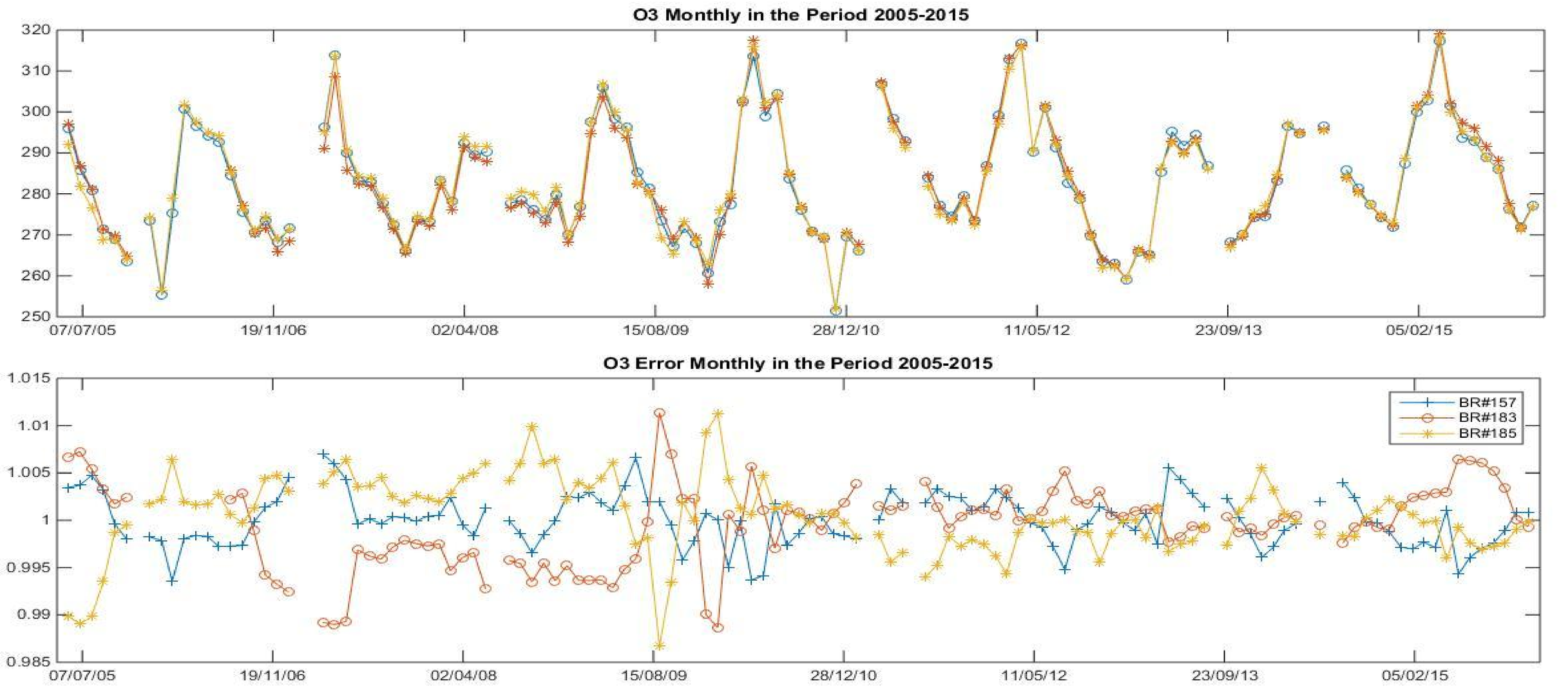
Ozone data evaluation using Fioletov method

This work is focused on the study of the stability of the RBCCE Triad from the method proposed by Fioletov et al.[1]. The daily Ozone values measured are fitted with a 2nd grade polynomial, as originally proposed in Ref. [1], and with an extended 3rd grade polynomial [2]:

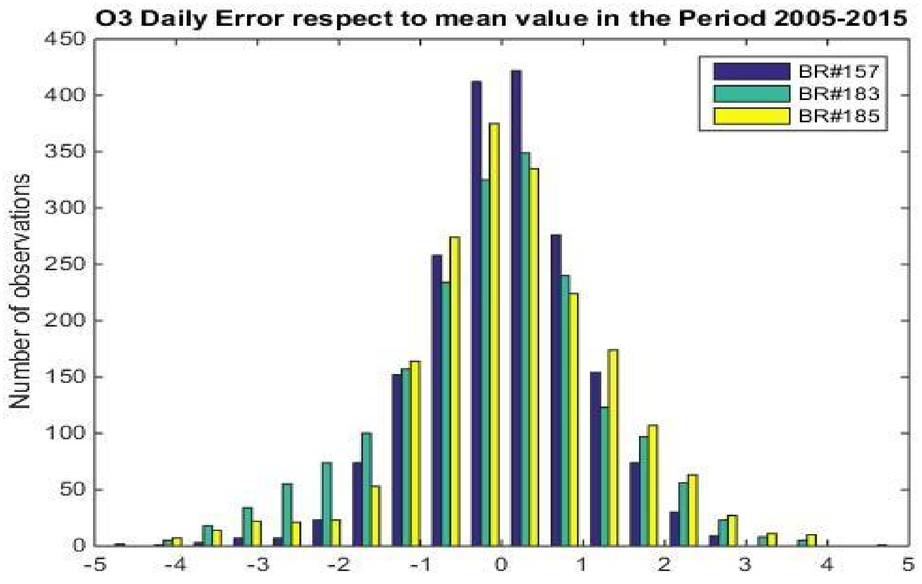
$$\Omega = A + B\cdot(t-t_0) + C\cdot(t-t_0)^2$$

$$\Omega = A + B\cdot(t-t_0) + C\cdot(t-t_0)^2 + D\cdot(t-t_0)^3$$

where Ω is an ozone measured by each brewer of the Triad, t is the corresponding time of the measurement and t_0 is the time of local solar noon. The coefficients A, B, C and D were estimated by the least-squares method. The coefficient A for a particular day can be interpreted as an average of all measurements on that day from Brewer 157, 183 or 185 with diurnal ozone variations relative to the noon ozone value removed.



In the upper figure, the A coefficient obtained from the fitted of the daily ozone measurements to 2nd grade polynomial, as suggest Fioletov at al.[1] was averaged monthly for each brewer. The ratio between the mean value of the three coefficient $A_M=(A_{157}+A_{183}+A_{185})/3$ and the particular coefficient of each brewer can be used as a benchmark to estimate the performance of the instrument. As can be observed, the error is lower than 1% for the period 2005-2015.



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In the left figure is shown the error distribution between the A coefficient obtained for each brewer daily respect to mean value, $A_D=(A_{157}+A_{183}+A_{185})/3$ calculated only for the days where the three brewers are measured. As it can be observed, the error distribution presents a good Gaussian profile what confirms than the brewer triad presents an excellent stability.

We filter the ozone data using:

- Only days with 15 DS measurements distributed between before and after solar noon and std <0.5 are selected.
- Remove data from Brewer 185 during campaign.
- Remove days detected faults (tracker problem, temperature control, high humidity, etc.)

Summary

- In the period 2005 – 2015, the triad presents a good agreement between the brewers. Especially, in the last 5 years, due to the improvement introduced by several short term scientific mission and different experiments carried out during the calibration campaigns.
- This study has been carried out using ozone measurements available in EUBREWNET data server as part of the tested work of this server.

Acknowledgments

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References

[1] V.E. Fioletov, J. B. Kerr, C.T. McElroy, D.I. Wardle, V. Savastiouk and T.S. Granjkar, "The Brewer reference Triad", Geophys. Res. Lett., 32, L208805.

[2] René Stübi, Herbertt, Schill, Werner Siegrist, "The Arosa Triad: Report on data quality", Oral presentation, Eubrewnet Meeting 2014, Santa Cruz de Tenerife, Spain